

VALLEY WATER MANAGEMENT COMPANY

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February 26, 2018

Mr. Clay Rodgers (Clay.Rodgers@waterboards.ca.gov)
Ms. Alejandra Lopez (Alejandra.Lopez@waterboards.ca.gov)
Central Valley Regional Water Quality Control Board
1685 E Street
Fresno, CA 93706

Dear Mr. Rodgers and Ms. Lopez,

Valley Water Management Company (Valley Water) submits this letter to provide comments to Proposed Resolution R5-2017-0031 and the proposed Monitoring and Reporting Program (MRP). We believe these orders are premature at this point, because Valley Water has been working cooperatively with the Central Valley Regional Water Quality Control Board (Regional Board) and has voluntarily been monitoring for many years. Valley Water is also currently engaged with your staff and is in the process of coming to agreement on the technical basis for moving forward with a sampling plan, but we are not yet at that point. We believe that the technical basis will be enhanced once Valley Water and Regional Board Staff have agreement on underlying technical issues. Until then, this matter is premature and should not be brought to the Regional Board for a hearing until there is a firmer grounding in fact.

Similarly, this regulatory action is premature because the Regional Board is poised to adopt new Basin Plan amendments in the next few months designed to deal with the exact types of salinity issues being addressed in the proposed Resolution. The proposed regulatory actions ignore the fact that Valley Water has been actively participating for many years in CV-SALTS and the Central Valley Salinity Coalition, which seek reasonable and feasible means to address the salinity issues in the Central Valley over the long term. In addition, the proposed regulatory actions not only make the Alternative Salinity Permitting Strategies being proposed for adoption in the near future irrelevant, but also create yet another permitting/regulatory construct outside of the three oil and gas General Orders (GOs) that were supposed to address facilities such as Valley Water's McKittrick facility.

With regard to the technical issues still outstanding, four principal facts are being currently being addressed with your staff, particularly in relation to the Clean Harbors facility downgradient from Valley Water's McKittrick facility. These facts are resolvable, and are a necessary precondition to considering the topic of the Resolution. The following is a list of the main issues we are seeking to resolve with Regional Board Staff:

1. A shared understanding of the stratigraphy in the area and how it affects fate and transport of produced water and irrigation water. The Resolution contains mistakes that staff has already agreed should be changed, which directly affect the Resolution. For example, the Corcoran Clay Equivalent (CCE) does not separate the upper and deeper Tulare Formations at Valley Water's facility, as suggested in Finding 6. This mistakenly claims that perched water at Valley Water's facility may be equivalent to perched water at Clean Harbors. This is incorrect. A correct understanding of the stratigraphy makes it clear that it is not possible for produced water from McKittrick to travel upwards and be found above the CCE at Clean Harbors. The downgradient flow to the Upper Zone at Clean Harbors is a central concern of the Resolution, but the facts (already agreed to by Valley Water and Regional Board staff) belie this conclusion.
2. A shared understanding of the comparative groundwater geochemistry between that beneath Valley Water, and that beneath Clean Harbors. Proposed Resolution Findings 8 and 9 completely rely on Total Dissolved Solids (TDS) and chloride to conclude that produced water from Valley has affected Upper Zone and Intermediate Zone water beneath Clean Harbors. The associated staff report incorrectly concludes that boron (which is relatively abundant in produced water) is not a conservative tracer and, therefore, dismisses further consideration. However, the fact is that perched water at Clean Harbors is most notably associated with relatively high concentrations of nitrogen compounds, and relatively low concentrations of boron. Taken together, the geochemistry indicates that the limited area of perched water at Clean Harbors is not impacted by produced water. Rather, it appears to be impacted by irrigation in adjacent fields just to the north. The Resolution does not consider these key facts: the timing of the occurrence of perched water at Clean Harbors, which was found at times when three sentinel wells in Section 17 indicated that produced water was still a mile away from Clean Harbors, the presence of perched water at Clean Harbors in a formation above that affected at McKittrick, and the agricultural character of the water beneath Clean Harbors.
3. A shared understanding of the location of beneficial uses of area groundwater. The Resolution wrongly implies that an agricultural well with 18,000 mg/L TDS was affected by Valley Water; in fact, this well was the subject of litigation between Aera and Starrh Farms, and is located far from Valley Water's area of influence. Proposed Resolution Finding 5 also implies that agricultural *land* is equivalent to a well, and that cross-gradient wells (owned by Starrh Farms) are down gradient wells. The Resolution does not mention that the aquifers used by agricultural wells are deeper, and in different aquifers, than the perched produced water beneath McKittrick. The distinctions here are very significant, because the Proposed Resolution implies a condition of imminent threat, when

this may not actually be the case.

4. Valley's draft groundwater model was discussed with you, Pamela Creedon, and your staff to add any components that Regional Board staff would like to see addressed by the model. Valley Water has already worked with Regional Board staff to develop a draft groundwater model, and presented the draft results on January 10, 2018. We expressed full willingness to work with Board staff to ensure that the model parameters are agreeable to Board staff. Clearly, this area would benefit from quantification of the existing conditions, as a basis to predict potential future conditions. However, we believe premature consideration of this Proposed Resolution by the Regional Board would forestall development of a quantitative tool to support fact-based decisions.

Because these four items are fundamental to future considerations of the facility, and because there is active work to better describe these considerations, we believe a Regional Board vote on the matter is premature and should be postponed temporarily.

The Resolution itself states:

"The Central Valley Water Board directs staff to take appropriate action to compel Valley Water to come into compliance with existing requirements, to submit for the Board's consideration a report of waste discharge to receive an updated set of individual waste discharge requirements issued under Water Code section 13263, or to cease discharging. Compliance options may include the development of a Cease and Desist Order pursuant to Water Code section 13301 for the Board's consideration or the issuance of a Time Schedule Order under Water Code section 13300, either of which would provide a detailed time schedule of specific actions that Valley Water must take in order to ensure the appropriate protection of underlying groundwater."

Once we arrive at a shared understanding of the key site features and modify the groundwater model to address Regional Board staff concerns, Valley Water would support an update of the Waste Discharge Requirements at the facility, consistent with the Alternative Salinity Permitting strategy scheduled to be adopted by the Regional Board in May.

The remainder of this comment letter addresses the key components of the technical basis for the Proposed Resolution.

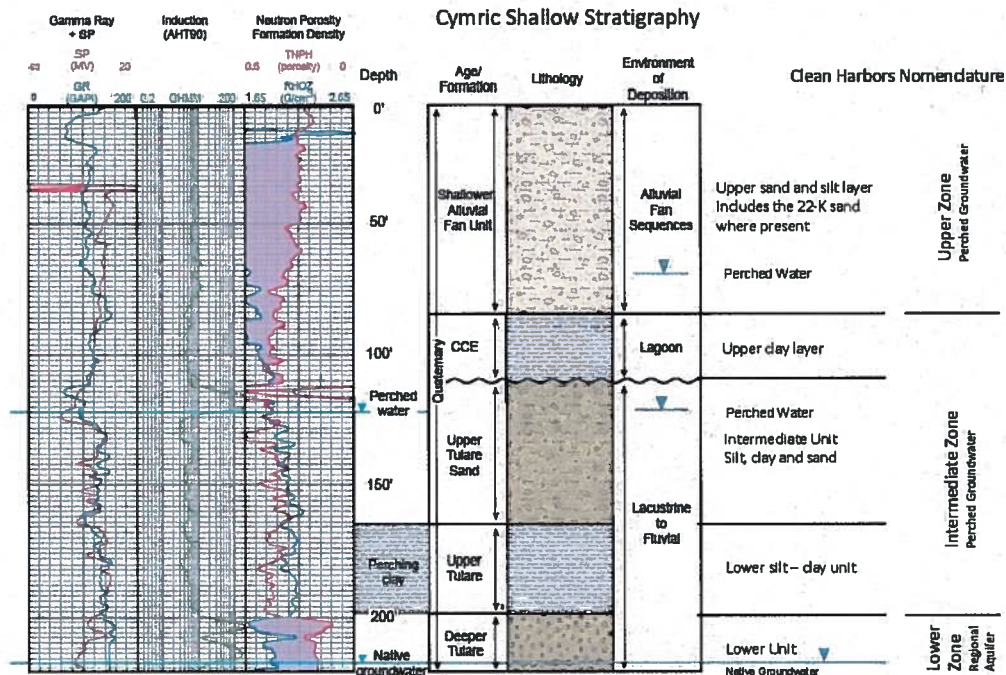
Stratigraphy

During our meeting with the Regional Board on January 10, 2018, the subject of the area stratigraphy was discussed. Valley reviewed additional data, and worked with Board staff member Doug Wachtell to address the relative stratigraphy between the Valley facility and the downgradient Clean Harbors facility at the locations shown in Figure 1.

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Figure 2: Comparative Stratigraphic Column



Hydrogeologic sections A-A' and B-B' in Figures 3 and 4 have been revised based on the updated stratigraphic correlation and reveal the connection between the Upper Perched Zone under the northwest portion of Clean Harbors facility and the Upper Alluvium under the McKittrick facility.

This change in stratigraphic correlation is highly significant in determining whether water in the Upper Perched Zone beneath Clean Harbors may be from McKittrick. There is no known physical mechanism whereby water from Valley, which first occurs *beneath* the CCE, could travel downgradient to Clean Harbors, and then migrate upwards *through* the CCE.

Figure 3: Hydrogeologic Section A-A'

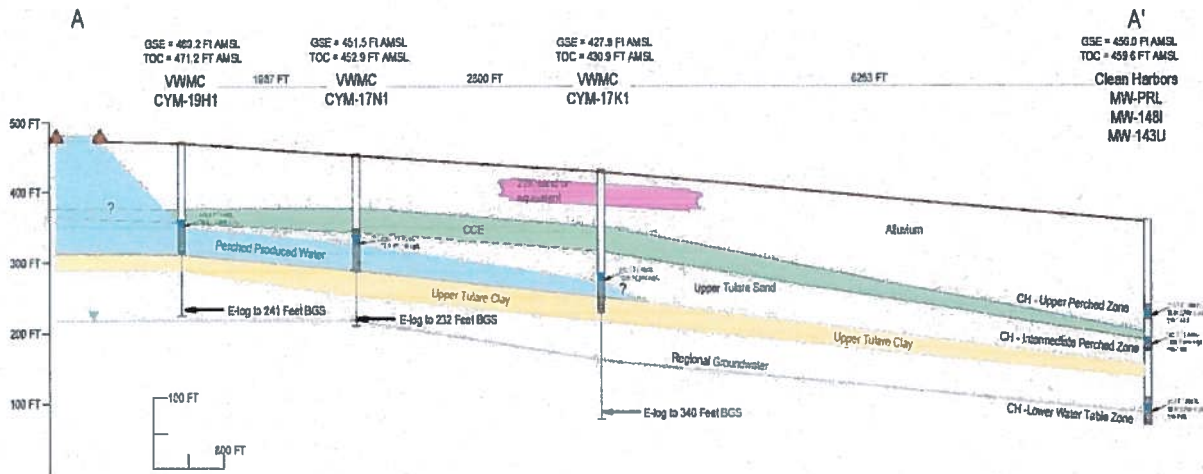
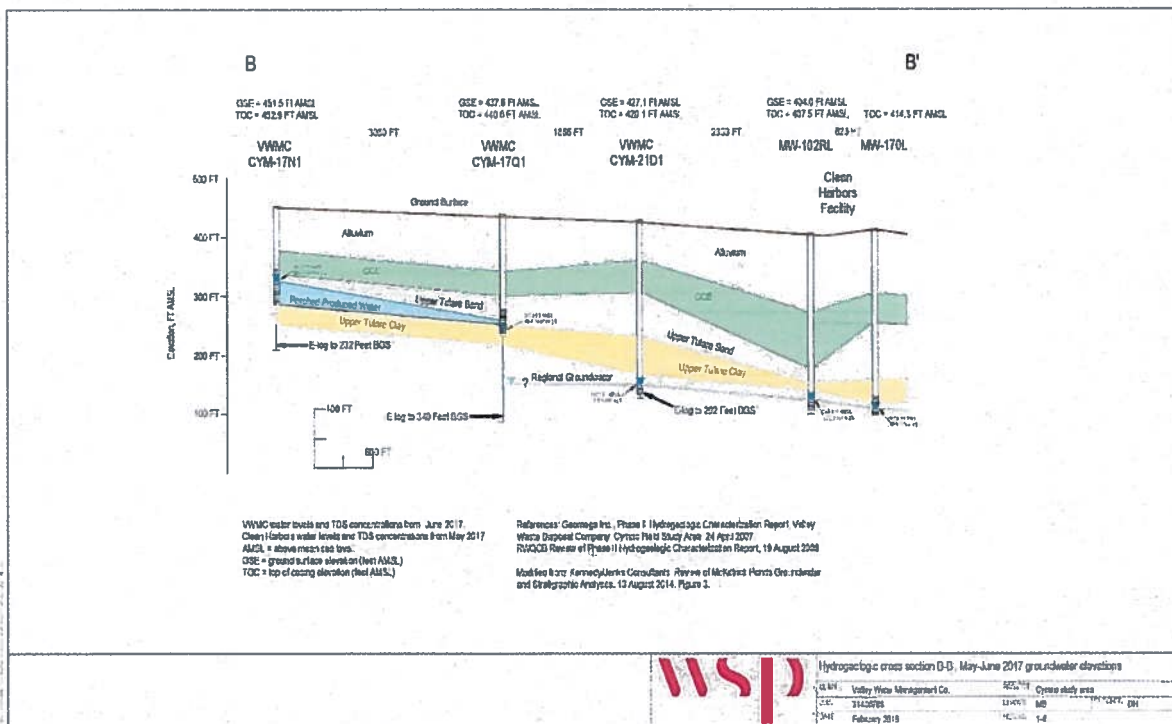


Figure 4: Hydrogeologic Section B-B'

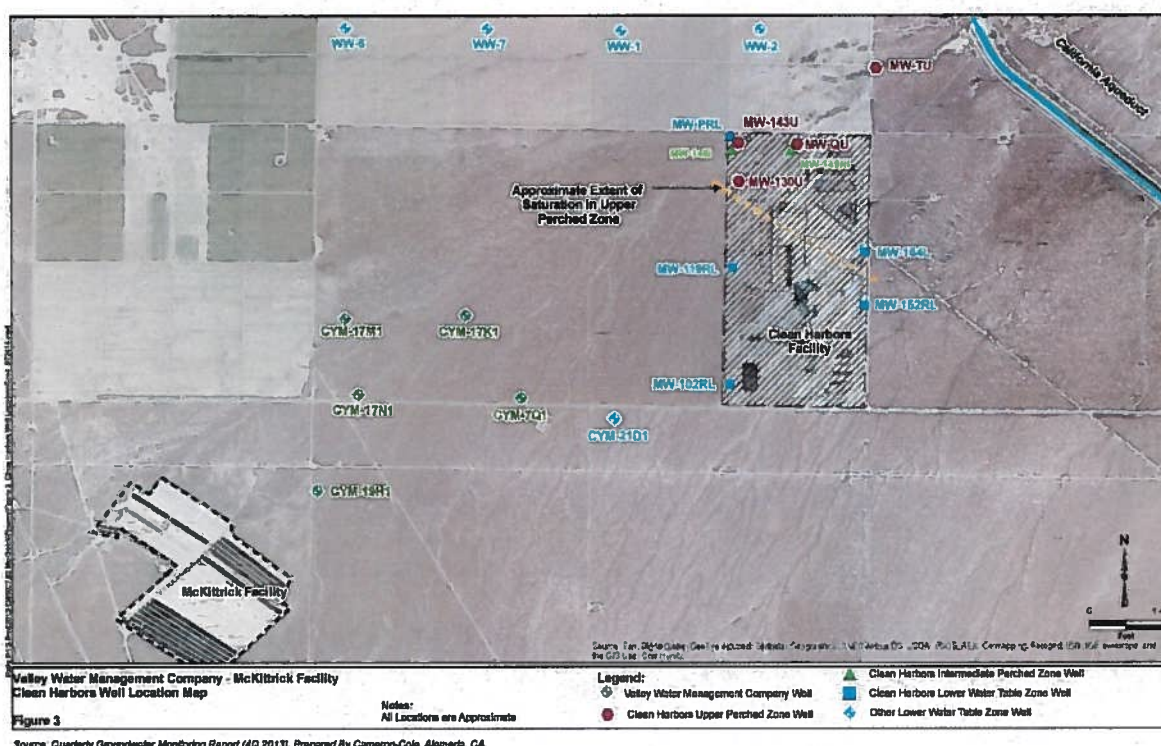


The “Upper Tulare Sand” beneath McKittrick corresponds to the “Intermediate Perched Zone” beneath Clean Harbors. Both of these units underlay the CCE, and are perched above a prominent clay layer that is laterally continuous. This unit contains water beneath both McKittrick and Clean Harbors. These units are in a lacustrine to fluvial (relatively still water) environment, compared to the Upper Alluvium/Upper Perched Zone, which is in an alluvial fan environment that may have very heterogeneous

deposits. Lacustrine to fluvial units are more homogeneous, and would be expected to be laterally continuous as observed here.

As described more fully below, under *Groundwater Geochemistry*, beneath the McKittrick facility the water in the Upper Tulare Sand contains produced waters from the overlying ponds, while beneath Clean Harbors facility, the water in the Intermediate Perched Zone appears to be from local irrigation infiltration. Figure 5 shows the location of the facilities, and the only water in the Clean Harbors Upper Perched Zone and Intermediate Zone is adjacent to the irrigated agriculture northwest of the facility. The water found in both zones of Clean Harbors is relatively rich in nitrate (as expected from irrigation return water) and poor in boron (boron is a good indicator of produced water, and does not appear to be elevated beneath Clean Harbors).

Figure 5: Location of Perched Water Beneath Clean Harbors



As can be seen in Figure 5, the perched water beneath Clean Harbors is in the area closest to the irrigated lands. The water found in the Upper Perched Zone beneath Clean Harbors cannot be from the McKittrick facility (as described above), but does contain compounds that implicate irrigated water. The water found in the Intermediate Perched Zone beneath Clean Harbors resembles that in the Upper Perched Zone and, therefore, is most likely to be Upper Perched Zone water that has seeped through the CCE to perch above the Upper Tulare perching clay/lower silt-clay unit (Figures 2 and 3).

Based on the stratigraphy recently developed between Valley Water and Regional Board staff, the water encountered in the Upper Perched Zone beneath Clean Harbors cannot be from or impacted by the McKittrick facility, and that similar water encountered in the Intermediate Perched Zone is almost certainly derived from the overlying Upper Perched Zone by infiltration through the CCE.

Groundwater Geochemistry

Valley Water has described the groundwater geochemistry and its implications for produced water from McKittrick possibly having reached beneath the Clean Harbors facility, most recently in Cymric Area Sampling and Analysis Report, First Semi-Annual 2017. We have also reviewed the Staff Report accompanying the Proposed Resolution. While the Staff Report is a good summary of the data, some very key points relevant to the Proposed Resolution must be corrected.

Constraints on Past Location of Valley Plume and Perched Water Beneath Valley Facilities. Groundwater quality has been regularly measured beneath the McKittrick facility. From 2006 to 2017, Valley “sentinel wells” CYM-17K1, CYM-17M1, and CYM-17Q1 did not contain groundwater. After 2014, these wells contained water with geochemical characteristics similar to those found in the McKittrick ponds; these data are a strong indicator that water from McKittrick reached these wells no earlier than 2014.

However, water has been in Clean Harbors Upper Perched Zone wells since at least 1990 and, therefore, could not have originated from Valley because the McKittrick water was still upgradient of the sentinel wells. As described in the Stratigraphy section of this letter, the water in the Upper Perched Zone beneath Clean Harbors corresponds to a dry layer (upper alluvium) beneath McKittrick, further indicating the water beneath Clean Harbors (CH) must have a different source.

Groundwater levels declined 12 to 15 feet in CH Upper Perched Zone wells MW-130U and MW-143U between 2005 and 2017 with well MW-130U now dry and well MW-143U containing only two feet of water in 2017. In contrast, water levels in VWMC Upper Tulare Sand well CYM-17N1 have remained constant during this time and water levels in sentinel wells CYM-17K1, 17M1, and 17Q1 have remained constant from 2014 to 2017 providing further evidence of a different source of perched water.

The groundwater level in CH Intermediate Perched Zone wells MW-148I and 149RI have decreased 7 to 17 feet from 2005 to 2017. This decreasing trend is consistent with the decreasing trend in the Upper Perched Zone, indicating a similar source of perched water.

Chloride, TDS, and Boron. Chloride and TDS concentrations had been increasing in Clean Harbors Upper Perched Zone wells MW-130U and MW-143U beginning in 2012 and 2013, prior to groundwater being encountered in VWMC sentinel wells CYM-17K1,

CYM-17M1, and CYM-17Q1. This timing indicates a completely different source of perched water.

Chloride and TDS concentrations have been increasing in CH Intermediate Perched Zone well MW-148I beginning in 2017, but boron concentrations have not increased. This indicates influence from the overlying Upper Perched Zone and not from produced water.

TDS concentrations in Clean Harbors Lower Water Table Zone well MW-102RL were stable between 2005 and 2014, when there was no water in the Valley Water sentinel wells, indicating that the Clean Harbors water was not from McKittrick. During this time, TDS beneath Clean Harbors ranged between 3,100 and 3,400 mg/L, slightly increased in 2015, and has remained stable through 2017. TDS concentrations in downgradient well MW-170L slightly increased in 2007, and have been generally decreasing since then. TDS concentrations in Valley Water's Lower Tulare Sand well CYM-21D1 increased from 2006 to 2017 with a concentration of 8,500 mg/l in 2017. This indicates that groundwater from Valley well CYM-21D1 has not reached Clean Harbors well MW-102RL.

Boron is a good indicator of produced water and is relatively high in Valley Water wells, ranging between 55 and 95 mg/L and between 30 and 70 mg/L in Valley Water's Upper Tulare Zone wells, indicating the influence of produced water. Boron is relatively low beneath Clean Harbors, supporting a different water source. Boron concentrations in Clean Harbors Upper Perched Zone wells MW-130U and MW-143U range from 4.7 to 12 mg/L and have not increased along with the chloride and TDS values, reinforcing a different source of perched water. Boron concentrations in CH Lower Water Table Zone wells MW-102RL and MW-170L ranged from 8.4 to 11 mg/L between 2005 and 2017 with no apparent trends. As noted by staff, boron concentrations have been increasing in VWMC well CYM-21D1.

The Staff Report accompanying the Proposed Resolution suggests that boron is not a conservative tracer, so that its low concentrations beneath Clean Harbors may not indicate a separate source. However, according to Hem¹, in natural waters, boron tends to be in the uncharged ionic state and, therefore, boron is not likely to be adsorbed on mineral surfaces. Supporting this finding that boron is a conservative tracer in this area is that water in the Valley Water well screened in the deeper Tulare Formation (CYM-21D1) has boron levels consistent with produced water. This means that produced water had to have migrated through the substantial perching clay, without appreciable loss of boron.

¹ Hem, J. (1989) Study and Interpretation of the Chemical Characteristics of Natural Water, USGS Water Supply Paper 2254.

Nitrate Concentrations. Nitrate concentrations in MW-148I were 58 mg/L in 2017 versus 13 to 15 mg/L in Valley Water's Upper Tulare Sand wells. Nitrate is a very good indicator of a water source from the irrigated agricultural fields adjacent to the limited part of the Clean Harbors facility that contains perched groundwater (see Figure 2).

Location of Beneficial Uses of Area Groundwater

The Proposed Resolution states in Finding 5:

"There is agricultural land 1,500 feet north of the Facility and to the east of the Facility. Agricultural wells in the vicinity that are downgradient of the Facility have total dissolved solids (TDS) concentrations ranging from 2,300 mg/L to 6,800 mg/L. One agricultural well that appears to be impacted by oil field operations has a TDS of 18,000 mg/L."

The groundwater flow direction in this area is towards the northeast and the agricultural wells are cross-gradient to Valley. As such, potential threats to those wells are much less than for downgradient wells. As discussed in the next section, Valley suggests that the groundwater model commissioned for the McKittrick facility would be the appropriate tool for assessing potential threats. In addition, Valley believes that the agricultural wells must be screened in the regional aquifer, which is located beneath the perching clay upon which the produced water rests. This clay further protects the native groundwater.

With respect to the *"one agricultural well that appears to be impacted by oil field operations has a TDS of 18,000 mg/L"* it bears repeating that Valley Water believes Board staff is referring to a well located in Section 36 that was the subject of litigation between Starrh Farms and Aera in the South Belridge Field. The subject well is not downgradient of the McKittrick facility.

For agricultural wells located downgradient from the McKittrick facility, the comments in previous sections demonstrating that the water beneath Clean Harbors is not sourced nor impacted from Valley Water's ponds also applies to supply wells located further downgradient from Clean Harbors. If water from McKittrick has not reached Clean Harbors, it has certainly not reached wells further downgradient.

Modifications to Draft Groundwater Model

Valley Water is in the process of working with Regional Board staff in the development of a groundwater model of the vicinity of the McKittrick facility. We presented the draft results in a January 10, 2018 meeting in the Regional Board's office. The interaction was very productive, and focused on the need to come to consensus on stratigraphy, downgradient groundwater geochemistry, and locations of beneficial use of groundwater (both depth of sources and distance from the facility). Valley Water requests that this amicable process continue so that the resulting model will reflect a consensus view on the site, and be a valuable guide to future decision-making regarding the site. The results of the model would be very useful in determining the most effective and efficient

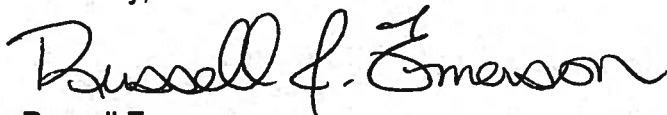
locations for additional monitoring, if the Monitoring and Reporting Program can be modified to include this element instead of some of the other prescriptive monitoring requirements being proposed.

Valley Water also takes issue with many of the findings and conclusions contained in the MRP, which discuss wells being impacted by produced water. For the same reasons discussed above, these findings are inaccurate and do not belong in an MRP. In addition, the MRP seems to cherry pick data and not provide all data, since some may not support the conclusions being made. If an MRP is being proposed, Valley Water suggests that a clean copy without specific findings and conclusions, such as the MRP for one of the GOs for Oil and Gas facilities be used instead to be less inflammatory and controversial. In addition, many of the MRP's requirements, including the following appear unnecessary:

- Pg. 7 - Requiring flow in both million gallons per day (MGD) and barrels/day
- Pg. 8 – Requiring mass and volume in gallons and kilograms
- Pg. 9 – Requiring new solid waste sampling not contained in the GOs.
- Pg. 10 – Requiring a well survey for 2.5 miles out, instead of 1 mile under the GOs,

Finally, we reiterate our position that bringing this matter before the Board at this time is premature, because the findings supporting the Proposed Resolution are currently inaccurate and should be modified based on the new information and productive discussions being had between Valley Water and Regional Board staff. As previously stated, Valley Water would support an update of the Waste Discharge Requirements at the McKittrick facility, including a Time Schedule Order to establish clear steps with scheduled completion times that would allow Valley to come into compliance with the revised WDR once the proposed Basin Plan amendments designed to address salinity permitting are adopted and included therein.

Sincerely,

A handwritten signature in black ink that reads "Russell Emerson". The signature is fluid and cursive, with the first name "Russell" and last name "Emerson" clearly legible.

Russell Emerson
Manager, Valley Water Management Company

cc: Jean Pledger, VWMC General Counsel
Melissa Thorne, Downey Brand LLP
Jim Waldron